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(54) **SYSTEMS, METHODS, AND APPARATUSES FOR ROUTING API CALLS**

(71) Applicant: **CDK GLOBAL, LLC**, Hoffman Estates, IL (US)

(72) Inventors: **Julian Sydney Birkett**, Thatcham (GB); **Gregory Lionel Birkett**, Thatcham (GB); **Daniel Timothy New**, Portland, OR (US); **Sahaswaranamam Subramanian**, Foxriver Grove, IL (US)

(73) Assignee: **CDK GLOBAL, LLC**, Hoffman Estates, IL (US)

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(56) **References Cited**

U.S. PATENT DOCUMENTS

3,792,445	A	2/1974	Bucks et al.
4,258,421	A	3/1981	Juhasz et al.
4,992,940	A	2/1991	Dworkin
5,003,476	A	3/1991	Abe
5,034,889	A	7/1991	Abe
5,058,044	A	10/1991	Stewart et al.
5,421,015	A	5/1995	Khoyi et al.
5,442,553	A	8/1995	Parrillo
5,452,446	A	9/1995	Johnson
5,521,815	A	5/1996	Rose, Jr.
5,649,186	A	7/1997	Ferguson
5,694,595	A	12/1997	Jacobs et al.
5,729,452	A	3/1998	Smith et al.
5,787,177	A	7/1998	Leppek
5,790,785	A	8/1998	Klug et al.
5,835,712	A	11/1998	Dufresne
5,845,299	A	12/1998	Arora et al.
5,862,346	A	1/1999	Kley et al.
5,911,145	A	6/1999	Arora et al.
5,956,720	A	9/1999	Fernandez et al.
5,974,149	A	10/1999	Leppek

(Continued)

FOREIGN PATENT DOCUMENTS

CA	2494350	5/2004
EP	0461888	3/1995

OTHER PUBLICATIONS

Clemens Grelck, A Multithreaded Compiler Backend for High-Level Array Programming. (Year: 2003).*

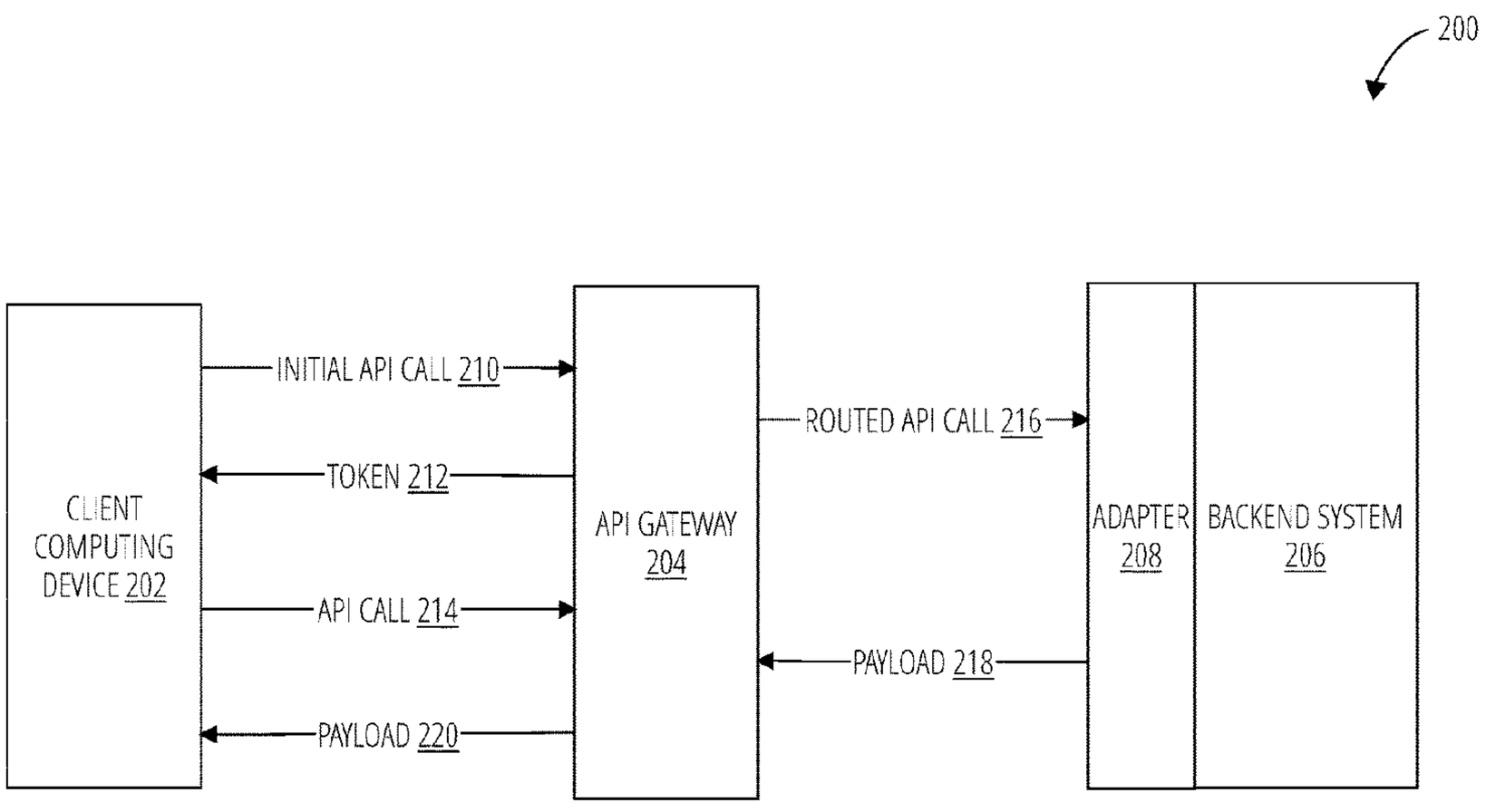
(Continued)

Primary Examiner — Lechi Truong
(74) *Attorney, Agent, or Firm* — Stoel Rives LLP

(57) **ABSTRACT**

The present disclosure relates to methods, systems and apparatuses for routing API calls to multiple backend systems that share a common API. A system may receive an API call comprising a unique identifier from a client computing device. The system may identify the unique identifier in the API call, and determine a target backend system associated with the unique identifier from the plurality of backend systems. Further, the system may route the API call to the target backend system based on the unique identifier.

14 Claims, 5 Drawing Sheets



(56) **References Cited**

U.S. PATENT DOCUMENTS

5,974,418	A	10/1999	Blinn et al.
5,974,428	A	10/1999	Gerard et al.
5,978,776	A	11/1999	Seretti et al.
5,987,506	A	11/1999	Carter et al.
6,003,635	A	12/1999	Bantz et al.
6,006,201	A	12/1999	Berent et al.
6,009,410	A	12/1999	Lemole et al.
6,018,748	A	1/2000	Smith
6,021,416	A	2/2000	Dauerer et al.
6,021,426	A	2/2000	Douglis et al.
6,026,433	A	2/2000	D'Arlach et al.
6,041,310	A	3/2000	Green et al.
6,041,344	A	3/2000	Bodamer et al.
6,055,541	A	4/2000	Solecki et al.
6,061,698	A	5/2000	Chadha et al.
6,067,559	A	5/2000	Allard et al.
6,070,164	A	5/2000	Vagnozzi
6,134,532	A	10/2000	Lazarus et al.
6,151,609	A	11/2000	Truong
6,178,432	B1	1/2001	Cook et al.
6,181,994	B1	1/2001	Colson et al.
6,185,614	B1	2/2001	Cuomo et al.
6,189,104	B1	2/2001	Leppek
6,216,129	B1	4/2001	Eldering
6,219,667	B1	4/2001	Lu et al.
6,236,994	B1	5/2001	Schwartz et al.
6,240,365	B1	5/2001	Bunn
6,263,268	B1	7/2001	Nathanson
6,285,932	B1	9/2001	De Belledeuille et al.
6,289,382	B1	9/2001	Bowman-Amuah
6,295,061	B1	9/2001	Park et al.
6,330,499	B1	12/2001	Chou et al.
6,343,302	B1	1/2002	Graham
6,353,824	B1	3/2002	Boguraev et al.
6,356,822	B1	3/2002	Diaz et al.
6,374,241	B1	4/2002	Lamburt et al.
6,397,226	B1	5/2002	Sage
6,397,336	B2	5/2002	Leppek
6,401,103	B1	6/2002	Ho et al.
6,421,733	B1	7/2002	Tso et al.
6,473,849	B1	10/2002	Keller et al.
6,496,855	B1	12/2002	Hunt et al.
6,505,106	B1	1/2003	Lawrence et al.
6,505,205	B1	1/2003	Kothuri et al.
6,519,617	B1	2/2003	Wanderski et al.
6,535,879	B1	3/2003	Behera
6,539,370	B1	3/2003	Chang et al.
6,546,216	B2	4/2003	Mizoguchi et al.
6,553,373	B2	4/2003	Boguraev et al.
6,556,904	B1	4/2003	Larson et al.
6,564,216	B2	5/2003	Waters
6,571,253	B1	5/2003	Thompson et al.
6,581,061	B2	6/2003	Graham
6,583,794	B1	6/2003	Wattenberg
6,594,664	B1	7/2003	Estrada et al.
6,606,525	B1	8/2003	Muthuswamy et al.
6,629,148	B1	9/2003	Ahmed et al.
6,643,663	B1	11/2003	Dabney et al.
6,654,726	B1	11/2003	Hanzek
6,678,706	B1	1/2004	Fishel
6,697,825	B1	2/2004	Underwood et al.
6,701,232	B2	3/2004	Yamaki
6,721,747	B2	4/2004	Lipkin
6,728,685	B1	4/2004	Ahluwalia
6,738,750	B2	5/2004	Stone et al.
6,744,735	B1	6/2004	Nakaguro
6,748,305	B1	6/2004	Klausner et al.
6,785,864	B1	8/2004	Te et al.
6,795,819	B2	9/2004	Wheeler et al.
6,823,258	B2	11/2004	Ukai et al.
6,823,359	B1	11/2004	Heidingsfeld
6,826,594	B1	11/2004	Pettersen
6,847,988	B2	1/2005	Toyouchi et al.
6,850,823	B2	2/2005	Eun et al.
6,871,216	B2	3/2005	Miller et al.
6,901,430	B1	3/2005	Smith
6,894,601	B1	5/2005	Grunden et al.
6,917,941	B2	7/2005	Wight et al.
6,922,674	B1	7/2005	Nelson
6,941,203	B2	9/2005	Chen
6,944,677	B1	9/2005	Zhao
6,954,731	B1	10/2005	Montague et al.
6,963,854	B1	11/2005	Boyd et al.
6,965,806	B2	11/2005	Eryurek et al.
6,965,968	B1	11/2005	Touboul
6,978,273	B1	12/2005	Bonneau et al.
6,981,028	B1	12/2005	Rawat et al.
6,990,629	B1	1/2006	Heaney et al.
6,993,421	B2	1/2006	Pillar
7,000,184	B2	2/2006	Matveyenko et al.
7,003,476	B1	2/2006	Samra et al.
7,028,072	B1	4/2006	Kliger et al.
7,031,554	B2	4/2006	Iwane
7,039,704	B2	5/2006	Davis et al.
7,047,318	B1	5/2006	Svedloff
7,062,343	B2	6/2006	Ogushi et al.
7,062,506	B2	6/2006	Taylor et al.
7,072,943	B2	7/2006	Landesmann
7,092,803	B2	8/2006	Kapolka et al.
7,107,268	B1	9/2006	Zawadzki et al.
7,124,116	B2	10/2006	Huyler
7,152,207	B1	12/2006	Underwood et al.
7,155,491	B1	12/2006	Schultz et al.
7,171,418	B2	1/2007	Blessin
7,184,866	B2	2/2007	Squires et al.
7,197,764	B2	3/2007	Cichowlas
7,219,234	B1	5/2007	Ashland et al.
7,240,125	B2	7/2007	Fleming
7,246,263	B2	7/2007	Skingle
7,281,029	B2	10/2007	Rawat
7,287,000	B2	10/2007	Boyd et al.
7,322,007	B2	1/2008	Schowtka et al.
7,386,786	B2	6/2008	Davis et al.
7,401,289	B2	7/2008	Lachhwani et al.
7,406,429	B2	7/2008	Salonen
7,433,891	B2	10/2008	Haber et al.
7,457,693	B2	11/2008	Olsen et al.
7,477,968	B1	1/2009	Lowrey
7,480,551	B1	1/2009	Lowrey et al.
7,496,543	B1	2/2009	Bamford et al.
7,502,672	B1	3/2009	Kolls
7,536,641	B2	5/2009	Rosenstein et al.
7,548,985	B2	6/2009	Guigui
7,587,504	B2	9/2009	Adams et al.
7,590,476	B2	9/2009	Shumate
7,593,925	B2	9/2009	Cadiz et al.
7,593,999	B2	9/2009	Nathanson
7,613,627	B2	11/2009	Doyle et al.
7,620,484	B1	11/2009	Chen
7,624,342	B2	11/2009	Matveyenko et al.
7,657,594	B2	2/2010	Banga et al.
7,664,667	B1	2/2010	Ruppelt et al.
7,739,007	B2	6/2010	Logsdon
7,747,680	B2	6/2010	Ravikumar et al.
7,778,841	B1	8/2010	Bayer et al.
7,801,945	B1	9/2010	Geddes et al.
7,818,380	B2	10/2010	Tamura et al.
7,861,309	B2	12/2010	Spearman et al.
7,865,409	B1	1/2011	Monaghan
7,870,253	B2	1/2011	Muilenburg et al.
7,899,701	B1	3/2011	Odom
7,908,051	B2	3/2011	Oesterling
7,979,506	B2	7/2011	Cole
8,010,423	B2	8/2011	Bodin et al.
8,019,501	B2	9/2011	Breed
8,036,788	B2	10/2011	Breed
8,051,159	B2	11/2011	Muilenburg et al.
8,055,544	B2	11/2011	Ullman et al.
8,060,274	B2	11/2011	Boss et al.
8,095,403	B2	1/2012	Price
8,099,308	B2	1/2012	Uyeki
8,135,804	B2	3/2012	Uyeki
8,145,379	B2	3/2012	Schwinke
8,190,322	B2	5/2012	Lin et al.

(56) **References Cited**

U.S. PATENT DOCUMENTS

8,209,259	B2	6/2012	Graham, Jr. et al.	
8,212,667	B2	7/2012	Petite et al.	
8,271,473	B2	9/2012	Berg	
8,271,547	B2	9/2012	Taylor et al.	
8,275,717	B2	9/2012	Ullman et al.	
8,285,439	B2	10/2012	Hodges	
8,296,007	B2	10/2012	Swaminathan et al.	
8,311,905	B1	11/2012	Campbell et al.	
8,355,950	B2	1/2013	Colson et al.	
8,407,664	B2	3/2013	Moosmann et al.	
8,428,815	B2	4/2013	Van Engelshoven et al.	
8,438,310	B2	5/2013	Muilenburg et al.	
8,521,654	B2	8/2013	Ford et al.	
8,538,894	B2	9/2013	Ullman et al.	
8,645,193	B2	2/2014	Swinson et al.	
8,676,638	B1	3/2014	Blair et al.	
8,725,341	B2	5/2014	Ogasawara	
8,745,641	B1 *	6/2014	Coker	G06F 11/3668 719/328
8,849,689	B1	9/2014	Jagannathan et al.	
8,886,389	B2	11/2014	Edwards et al.	
8,924,071	B2	12/2014	Stanek et al.	
8,954,222	B2	2/2015	Costantino	
8,996,230	B2	3/2015	Lorenz et al.	
8,996,235	B2	3/2015	Singh et al.	
9,014,908	B2	4/2015	Chen et al.	
9,015,059	B2	4/2015	Sims et al.	
9,026,304	B2	5/2015	Olsen, III et al.	
9,047,722	B2	6/2015	Kurnik et al.	
9,165,413	B2	10/2015	Jones et al.	
9,183,681	B2	11/2015	Fish	
9,325,650	B2	4/2016	Yalavarty et al.	
9,349,223	B1	5/2016	Palmer	
9,384,597	B2	7/2016	Koch et al.	
9,577,866	B2	2/2017	Rogers et al.	
9,596,287	B2	3/2017	Rybak et al.	
9,619,945	B2	4/2017	Adderly et al.	
9,659,495	B2	5/2017	Modica et al.	
9,706,008	B2	7/2017	Rajan et al.	
9,715,665	B2	7/2017	Schondorf et al.	
9,754,304	B2	9/2017	Taira et al.	
9,778,045	B2	10/2017	Bang	
9,836,714	B2	12/2017	Lander et al.	
10,032,139	B2	7/2018	Adderly et al.	
10,083,411	B2	9/2018	Kinsey et al.	
10,229,394	B1	3/2019	Davis et al.	
10,475,256	B2	11/2019	Chowdhury et al.	
2001/0005831	A1	6/2001	Lewin et al.	
2001/0014868	A1	8/2001	Herz et al.	
2001/0037332	A1	11/2001	Miller et al.	
2001/0039594	A1	11/2001	Park et al.	
2001/0054049	A1	12/2001	Maeda et al.	
2002/0023111	A1	2/2002	Arora et al.	
2002/0024537	A1	2/2002	Jones et al.	
2002/0026359	A1	2/2002	Long et al.	
2002/0032626	A1	3/2002	Dewolf et al.	
2002/0032701	A1	3/2002	Gao et al.	
2002/0042738	A1	4/2002	Srinivasan et al.	
2002/0046245	A1	4/2002	Hillar et al.	
2002/0049831	A1	4/2002	Platner et al.	
2002/0052778	A1	5/2002	Murphy et al.	
2002/0059260	A1	5/2002	Jas	
2002/0065698	A1	5/2002	Schick et al.	
2002/0065739	A1	5/2002	Florance et al.	
2002/0069110	A1	6/2002	Sonnenberg	
2002/0073080	A1	6/2002	Lipkin	
2002/0082978	A1	6/2002	Ghouri et al.	
2002/0091755	A1	7/2002	Narin	
2002/0107739	A1	8/2002	Schlee	
2002/0111727	A1	8/2002	Vanstory et al.	
2002/0111844	A1	8/2002	Vanstory et al.	
2002/0116418	A1	8/2002	Lachhwani et al.	
2002/0123359	A1	9/2002	Wei et al.	
2002/0124053	A1	9/2002	Adams et al.	
2002/0128728	A1	9/2002	Murakami et al.	
2002/0129054	A1	9/2002	Ferguson et al.	
2002/0133273	A1	9/2002	Lowrey et al.	
2002/0138331	A1	9/2002	Hosea et al.	
2002/0143646	A1	10/2002	Boyden et al.	
2002/0154146	A1	10/2002	Rodriquez et al.	
2002/0169851	A1	11/2002	Weathersby et al.	
2002/0173885	A1	11/2002	Lowrey et al.	
2002/0196273	A1	12/2002	Krause	
2002/0198761	A1	12/2002	Ryan et al.	
2002/0198878	A1	12/2002	Baxter et al.	
2003/0014443	A1	1/2003	Bernstein et al.	
2003/0023632	A1	1/2003	Ries et al.	
2003/0033378	A1	2/2003	Needham et al.	
2003/0036832	A1	2/2003	Kokes et al.	
2003/0036964	A1	2/2003	Boyden et al.	
2003/0037263	A1	2/2003	Kamat et al.	
2003/0046179	A1	3/2003	Anabtawi et al.	
2003/0051022	A1	3/2003	Sogabe et al.	
2003/0055666	A1	3/2003	Roddy et al.	
2003/0061263	A1	3/2003	Riddle	
2003/0065532	A1	4/2003	Takaoka	
2003/0065583	A1	4/2003	Takaoka	
2003/0069785	A1	4/2003	Lohse	
2003/0069790	A1	4/2003	Kane	
2003/0074392	A1	4/2003	Campbell et al.	
2003/0095038	A1	5/2003	Dix	
2003/0101262	A1	5/2003	Godwin	
2003/0115292	A1	6/2003	Griffin et al.	
2003/0120502	A1	6/2003	Robb et al.	
2003/0145310	A1	7/2003	Thames et al.	
2003/0177050	A1	9/2003	Crampton et al.	
2003/0177175	A1	9/2003	Worley et al.	
2003/0225853	A1	12/2003	Wang et al.	
2003/0229623	A1	12/2003	Chang et al.	
2003/0233246	A1	12/2003	Snapp et al.	
2004/0012631	A1	1/2004	Skorski	
2004/0039646	A1	2/2004	Hacker	
2004/0041818	A1	3/2004	White et al.	
2004/0073546	A1	4/2004	Forster et al.	
2004/0073564	A1	4/2004	Haber et al.	
2004/0088228	A1	5/2004	Mercer et al.	
2004/0093243	A1	5/2004	Bodin et al.	
2004/0117046	A1	6/2004	Colle et al.	
2004/0122735	A1	6/2004	Meshkin et al.	
2004/0128320	A1	7/2004	Grove et al.	
2004/0139203	A1	7/2004	Graham, Jr. et al.	
2004/0148342	A1	7/2004	Cotte	
2004/0156020	A1	8/2004	Edwards	
2004/0163047	A1	8/2004	Nagahara et al.	
2004/0181464	A1	9/2004	Vanker et al.	
2004/0199413	A1	10/2004	Hauser et al.	
2004/0220863	A1	11/2004	Porter et al.	
2004/0225664	A1	11/2004	Casement	
2004/0230897	A1	11/2004	Latzel	
2004/0255233	A1	12/2004	Croney et al.	
2004/0267263	A1	12/2004	May	
2004/0268225	A1	12/2004	Walsh et al.	
2004/0268232	A1	12/2004	Tunning	
2005/0015491	A1	1/2005	Koeppel	
2005/0021197	A1	1/2005	Zimmerman et al.	
2005/0027611	A1 *	2/2005	Wharton	G06Q 30/0641 705/26.62
2005/0065804	A1	3/2005	Worsham et al.	
2005/0096963	A1	5/2005	Myr et al.	
2005/0108112	A1	5/2005	Ellenson et al.	
2005/0114270	A1	5/2005	Hind et al.	
2005/0114764	A1	5/2005	Gudenkauf et al.	
2005/0108637	A1	6/2005	Sahota et al.	
2005/0149398	A1	7/2005	McKay	
2005/0171836	A1	8/2005	Leacy	
2005/0176482	A1	8/2005	Raisinghani et al.	
2005/0187834	A1	8/2005	Painter et al.	
2005/0228736	A1	10/2005	Norman et al.	
2005/0267774	A1	12/2005	Merritt et al.	
2005/0268282	A1	12/2005	Laird	
2005/0289020	A1	12/2005	Bruns et al.	
2005/0289599	A1	12/2005	Matsuura et al.	
2006/0031811	A1	2/2006	Ernst et al.	
2006/0059253	A1	3/2006	Goodman et al.	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2006/0064637	A1	3/2006	Rechterman et al.	
2006/0123330	A1	6/2006	Horiuchi et al.	
2006/0129423	A1	6/2006	Sheinson et al.	
2006/0129982	A1	6/2006	Doyle	
2006/0136105	A1	6/2006	Larson	
2006/0161841	A1	7/2006	Horiuchi et al.	
2006/0200751	A1	9/2006	Underwood et al.	
2006/0248442	A1	11/2006	Rosenstein et al.	
2006/0265355	A1	11/2006	Taylor	
2006/0271844	A1	11/2006	Suklikar	
2006/0277588	A1	12/2006	Harrington et al.	
2007/0005446	A1	1/2007	Fusz et al.	
2007/0016486	A1	1/2007	Stone et al.	
2007/0027754	A1	2/2007	Collins et al.	
2007/0033087	A1	2/2007	Combs et al.	
2007/0033520	A1	2/2007	Kimzey et al.	
2007/0053513	A1	3/2007	Hoffberg	
2007/0100519	A1	5/2007	Engel	
2007/0150368	A1	6/2007	Arora et al.	
2007/0209011	A1	9/2007	Padmanabhuni et al.	
2007/0226540	A1	9/2007	Konieczny	
2007/0250229	A1	10/2007	Wu	
2007/0250327	A1	10/2007	Hedy	
2007/0250840	A1*	10/2007	Coker	G06F 9/54 719/320
2007/0271154	A1	11/2007	Broudy et al.	
2007/0271330	A1	11/2007	Mattox et al.	
2007/0271389	A1	11/2007	Joshi et al.	
2007/0282711	A1	12/2007	Ullman et al.	
2007/0282712	A1	12/2007	Ullman et al.	
2007/0282713	A1	12/2007	Ullman et al.	
2007/0288413	A1	12/2007	Mizuno et al.	
2007/0294192	A1	12/2007	Tellefsen	
2008/0010561	A1	1/2008	Bay et al.	
2008/0015929	A1	1/2008	Koeppel et al.	
2008/0027827	A1	1/2008	Eglen et al.	
2008/0119983	A1	5/2008	Inbarajan et al.	
2008/0172632	A1	7/2008	Stambaugh	
2008/0189143	A1	8/2008	Wurster	
2008/0195435	A1	8/2008	Bentley et al.	
2008/0195932	A1	8/2008	Oikawa et al.	
2008/0201163	A1	8/2008	Barker et al.	
2008/0255925	A1	10/2008	Vailaya et al.	
2009/0012887	A1	1/2009	Taub et al.	
2009/0024918	A1	1/2009	Silverbrook et al.	
2009/0043780	A1	2/2009	Hentrich, Jr. et al.	
2009/0070435	A1	3/2009	Abhyanker	
2009/0089134	A1	4/2009	Uyeki	
2009/0106036	A1	4/2009	Tamura et al.	
2009/0112687	A1	4/2009	Blair et al.	
2009/0182232	A1	7/2009	Zhang et al.	
2009/0187513	A1	7/2009	Noy et al.	
2009/0187939	A1	7/2009	Lajoie	
2009/0204454	A1	8/2009	Lagudi	
2009/0222532	A1	9/2009	Finlaw	
2009/0265607	A1	10/2009	Raz et al.	
2009/0313035	A1	12/2009	Esser et al.	
2010/0023393	A1	1/2010	Costy et al.	
2010/0070343	A1	3/2010	Taira et al.	
2010/0082778	A1	4/2010	Muilenburg et al.	
2010/0082780	A1	4/2010	Muilenburg et al.	
2010/0088158	A1	4/2010	Pollack	
2010/0100259	A1	4/2010	Geiter	
2010/0100506	A1	4/2010	Marot	
2010/0235219	A1	9/2010	Merrick et al.	
2010/0235231	A1	9/2010	Jewer	
2010/0293030	A1	11/2010	Wu	
2010/0312608	A1	12/2010	Shan et al.	
2010/0318408	A1	12/2010	Sankaran et al.	
2010/0324777	A1	12/2010	Tominaga et al.	
2011/0010432	A1	1/2011	Uyeki	
2011/0015989	A1	1/2011	Tidwell et al.	
2011/0022525	A1	1/2011	Swinson et al.	
2011/0082804	A1	4/2011	Swinson et al.	
2011/0145064	A1	6/2011	Anderson et al.	
2011/0161167	A1	6/2011	Jallapuram	
2011/0191264	A1	8/2011	Inghelbrecht et al.	
2011/0196762	A1	8/2011	Dupont	
2011/0224864	A1	9/2011	Gellatly et al.	
2011/0231055	A1	9/2011	Knight et al.	
2011/0288937	A1	11/2011	Manoogian, III	
2011/0307411	A1	12/2011	Bolivar et al.	
2012/0066010	A1	3/2012	Williams et al.	
2012/0089474	A1	4/2012	Xiao et al.	
2012/0095804	A1	4/2012	Calabrese et al.	
2012/0116868	A1	5/2012	Chin et al.	
2012/0158211	A1	6/2012	Chen et al.	
2012/0209714	A1	8/2012	Douglas et al.	
2012/0221125	A1	8/2012	Bell	
2012/0268294	A1	10/2012	Michaelis et al.	
2012/0278886	A1	11/2012	Luna	
2012/0284113	A1	11/2012	Pollak	
2012/0316981	A1	12/2012	Hoover et al.	
2013/0046432	A1	2/2013	Edwards et al.	
2013/0080196	A1	3/2013	Schroeder et al.	
2013/0080305	A1	3/2013	Virag et al.	
2013/0151334	A1	6/2013	Berkhin et al.	
2013/0204484	A1	8/2013	Ricci	
2013/0325541	A1	12/2013	Capriotti et al.	
2013/0332023	A1	12/2013	Bertosa et al.	
2014/0026037	A1	1/2014	Garb et al.	
2014/0052327	A1	2/2014	Hosein et al.	
2014/0088866	A1	3/2014	Knapp et al.	
2014/0094992	A1	4/2014	Lambert et al.	
2014/0136278	A1	5/2014	Carvalho	
2014/0229391	A1	8/2014	East et al.	
2014/0244110	A1	8/2014	Tharaldson et al.	
2014/0277906	A1	9/2014	Lowrey et al.	
2014/0278805	A1	9/2014	Thompson	
2014/0316825	A1	10/2014	Van Dijk et al.	
2014/0324275	A1	10/2014	Stanek et al.	
2014/0337163	A1	11/2014	Whisnant	
2014/0379530	A1	12/2014	Kim et al.	
2015/0057875	A1	2/2015	McGinnis et al.	
2015/0066781	A1	3/2015	Johnson et al.	
2015/0066933	A1	3/2015	Kolodziej et al.	
2015/0100199	A1	4/2015	Kurnik et al.	
2015/0142256	A1	5/2015	Jones	
2015/0227894	A1	8/2015	Mapes, Jr. et al.	
2015/0268059	A1	9/2015	Borghesani et al.	
2015/0286979	A1	10/2015	Ming et al.	
2016/0004516	A1	1/2016	Ivanov et al.	
2016/0071054	A1	3/2016	Kakarala et al.	
2016/0092944	A1	3/2016	Taylor et al.	
2016/0132935	A1	5/2016	Shen et al.	
2016/0140609	A1	5/2016	Demir	
2016/0140620	A1	5/2016	Pinkowish et al.	
2016/0140622	A1	5/2016	Wang et al.	
2016/0148439	A1	5/2016	Akselrod et al.	
2016/0180358	A1	6/2016	Battista	
2016/0180378	A1	6/2016	Toshida et al.	
2016/0180418	A1	6/2016	Jaeger	
2016/0267503	A1	9/2016	Zakai-Or et al.	
2016/0275533	A1	9/2016	Smith et al.	
2016/0307174	A1	10/2016	Marcelle et al.	
2016/0357599	A1	12/2016	Glatfelter	
2017/0039785	A1	2/2017	Richter et al.	
2017/0053460	A1	2/2017	Hauser et al.	
2017/0064038	A1*	3/2017	Chen	G06F 16/951
2017/0124525	A1	5/2017	Johnson et al.	
2017/0262894	A1	9/2017	Kirti et al.	
2017/0293894	A1	10/2017	Taliwal et al.	
2017/0308844	A1	10/2017	Kelley	
2017/0308864	A1	10/2017	Kelley	
2017/0308865	A1	10/2017	Kelley	
2017/0316459	A1	11/2017	Strauss et al.	
2017/0337573	A1	11/2017	Toprak	
2017/0352054	A1	12/2017	Ma et al.	
2018/0225710	A1	8/2018	Kar et al.	
2018/0232749	A1	8/2018	Moore, Jr. et al.	
2018/0285901	A1	10/2018	Zackrone	
2018/0285925	A1	10/2018	Zackrone	

(56) **References Cited**

U.S. PATENT DOCUMENTS

2019/0297162	A1	9/2019	Amar et al.	
2019/0334884	A1*	10/2019	Ross	H04L 63/0442
2020/0038363	A1	2/2020	Kim	

OTHER PUBLICATIONS

Bo Hu1, A Platform based Distributed Service Framework for Large-scale Cloud Ecosystem Development. (Year: 2015).*
Open Bank Project , https://www.openbankproject.com/, retrieved Nov. 23, 2020, 10 pages.
Standards for Technology in Auto , https://www.starstandard.org/, retrieved Nov. 23, 2020, 4 pages.
U.S. Appl. No. 10/665,899, et al., Non-Final Office Action ,dated Aug. 30, 2010 ,23 pages.
U.S. Appl. No. 10/665,899, et al., Final Office Action ,dated Feb. 24, 2010 ,22 pages.
U.S. Appl. No. 10/665,899, et al., Final Office Action ,dated Jul. 7, 2008 ,11 pages.
U.S. Appl. No. 10/665,899, et al., Final Office Action ,dated Mar. 8, 2011 ,21 pages.
U.S. Appl. No. 10/665,899, et al., Final Office Action ,dated May 11, 2009 ,14 pages.
U.S. Appl. No. 10/665,899, et al., Non-Final Office Action ,dated Nov. 13, 2008 ,11 pages.
U.S. Appl. No. 10/665,899, et al., Non-Final Office Action ,dated Sep. 14, 2009 ,14 pages.
U.S. Appl. No. 10/665,899, et al., Non-Final Office Action ,dated Sep. 17, 2007 ,11 pages.
Anonymous, "Software ready for prime time", Automotive News. Detroit, vol. 76, Issue 5996, Nov. 5, 2001, 28 pages.
U.S. Appl. No. 11/149,909, et al., Final Office Action ,dated Feb. 4, 2009 ,14 pages.
U.S. Appl. No. 11/149,909, et al., Non-Final Office Action ,dated May 13, 2008 ,14 pages.
U.S. Appl. No. 11/149,909, et al., Non-Final Office Action ,dated May 6, 2009 ,6 pages.
U.S. Appl. No. 11/149,909, et al., Notice of Allowance ,dated Sep. 16, 2009 ,7 pages.
U.S. Appl. No. 11/414,939, et al., Non-Final Office Action ,dated Jul. 19, 2010 ,7 pages.
U.S. Appl. No. 11/414,939, et al., Non-Final Office Action ,dated Mar. 9, 2010 ,11 pages.
U.S. Appl. No. 11/414,939, et al., Notice of Allowance ,dated Nov. 2, 2010.
U.S. Appl. No. 11/442,821, et al., Final Office Action ,dated Apr. 7, 2009 ,19 pages.
U.S. Appl. No. 11/442,821, et al., Notice of Allowance ,dated Jul. 30, 2012 ,6 pages.
U.S. Appl. No. 11/442,821, et al., Non-Final Office Action ,dated Jun. 1, 2011 ,23 pages.
U.S. Appl. No. 11/442,821, et al., Final Office Action ,dated May 21, 2010 ,28 pages.
U.S. Appl. No. 11/442,821, et al., Non-Final Office Action ,dated Nov. 12, 2009 ,19 pages.
U.S. Appl. No. 11/442,821, et al., Final Office Action ,dated Nov. 29, 2011 ,26 pages.
U.S. Appl. No. 11/442,821, et al., Non-Final Office Action ,dated Sep. 3, 2008 ,14 pages.
U.S. Appl. No. 11/446,011, et al., Notice of Allowance ,dated Aug. 9, 2011 ,10 pages.
U.S. Appl. No. 11/446,011, et al., Final Office Action ,dated Jun. 8, 2010 ,12 pages.
U.S. Appl. No. 11/446,011, et al., Non-Final Office Action ,dated Mar. 1, 2011 ,15 pages.
U.S. Appl. No. 11/446,011, et al., Non-Final Office Action ,dated Nov. 27, 2009 ,14 pages.
U.S. Appl. No. 12/243,861, Notice of Allowance, dated Sep. 6, 2011, 10 pages.
Interconnection, In Roget's II The New Thesaurus. Boston, MA: Houghton Mifflin .credoreference.com/entry/hmrogets/interconnection, 1 page, 2003 Retrieved.
U.S. Appl. No. 11/524,602, et al., Notice of Allowance ,dated Aug. 6, 2013 ,22 pages.
U.S. Appl. No. 11/524,602, et al., Non-Final Office Action ,dated Dec. 11, 2009 ,20 pages.
U.S. Appl. No. 11/524,602, et al., Final Office Action ,dated Jul. 27, 2010 ,13 pages.
U.S. Appl. No. 11/524,602, et al., Final Office Action ,dated Jun. 26, 2012 ,11 pages.
U.S. Appl. No. 11/524,602, et al., Non-Final Office Action ,dated Nov. 14, 2011 ,19 pages.
U.S. Appl. No. 11/525,009, et al., Non-Final Office Action ,dated Aug. 10, 2011 ,18 pages.
U.S. Appl. No. 11/525,009, et al., Final Office Action ,dated Aug. 3, 2010 ,16 pages.
U.S. Appl. No. 11/525,009, et al., Non-Final Office Action ,dated Dec. 16, 2009 ,20 pages.
U.S. Appl. No. 11/525,009, et al., Notice of Allowance ,dated Jul. 23, 2012 ,19 pages.
U.S. Appl. No. 12/243,852, et al., Restriction Requirement ,dated Dec. 7, 2010.
U.S. Appl. No. 12/243,852, et al., Notice of Allowance ,dated Feb. 27, 2013 ,6 pages.
U.S. Appl. No. 12/243,852, et al., Non-Final Office Action ,dated Jan. 16, 2013 ,5 pages.
U.S. Appl. No. 12/243,852, et al., Non-Final Office Action ,dated Mar. 17, 2011 ,8 pages.
U.S. Appl. No. 12/243,852, et al., Supplemental Notice of Allowability ,dated Mar. 19, 2013 ,3 pages.
U.S. Appl. No. 12/243,852, et al., Final Office Action ,dated Oct. 24, 2011 ,13 pages.
U.S. Appl. No. 12/243,855, et al., Notice of Allowance ,dated Nov. 22, 2010 ,10 pages.
U.S. Appl. No. 12/243,855, et al., Non-Final Office Action ,dated Oct. 14, 2010 ,6 pages.
U.S. Appl. No. 12/243,855, et al., Notice of Allowance ,dated Oct. 28, 2010 ,5 pages.
U.S. Appl. No. 12/243,861, et al., Final Office Action ,dated Jun. 22, 2011 ,5 pages.
U.S. Appl. No. 12/243,861, et al., Non-Final Office Action ,dated Nov. 8, 2010 ,8 pgs.
U.S. Appl. No. 14/208,042, et al., Notice of Allowance ,dated May 6, 2021 ,13 pages.
U.S. Appl. No. 15/478,042, et al., Final Office Action ,dated May 5, 2021 ,38 pages.
U.S. Appl. No. 15/478,048, et al., Non-Final Office Action ,dated Mar. 8, 2021 ,69 pages.
U.S. Appl. No. 16/041,552, et al., Final Office Action ,dated Apr. 27, 2021 ,23 pages.
Johns,Pamela et al.,"Competitive intelligence in service marketing, Marketing Intelligence & Planning", vol. 28, No. 5 ,2010 ,pp. 551-570.
http://web.archive.org/web/20010718130244/http://chromedata.com/maing2/about/index.asp, 1 pg.
http://web.archive.org/web/20050305055408/http://www.dealerclick.com/, 1 pg.
http://web.archive.org/web/20050528073821/http://www.kbb.com/, 1 pg.
http://web.archive.org/web/20050531000823/http://www.carfax.com/, 1 pg.
Internet Archive Dan Gillmor Sep. 1, 1996.
Internet Archive Wayback Machine, archive of LDAP Browser.com—FAQ. Archived Dec. 11, 2000. Available at <http://web.archive.org/web/200012110152/http://www.ldapbrowser.com/faq/faq.php3?sID=fe4ae66f023d86909f35e974f3a1ce>.
Internet Archive Wayback Machine, archive of LDAP Browser.com—Product Info. Archived Dec. 11, 2000. Available at <http://web.archive.org/web/200012110541/.ldapbrowser.com/prodinfo/prodinfo.php3?sID=fe4ae66f2fo23d86909f35e974f3a1ce>.

(56) **References Cited**

OTHER PUBLICATIONS

Internet Archive: Audio Archive, archive.org/audio/audio-searchresults.php?search=@start=0&limit=100&sort=ad, printed May 12, 2004, 12 pgs.
Internet Archive: Democracy Now, archive.org/audio/collection.php?collection=democracy_now, printed May 12, 2004, 2 pgs.
Java 2 Platform, Enterprise Edition (J2EE) Overview, printed Mar. 6, 2010, 3 pgs.
Java version history—Wikipedia, the free encyclopedia, printed Mar. 6, 2010, 9 pgs.
Permissions in the Java™ 2 SDK, printed Mar. 6, 2010, 45 pgs.
Trademark Application, Serial No. 76375405. 13 pages of advertising material and other application papers enclosed. Available from Trademark Document Retrieval system at.
Trademark Electronic Search System record for Serial No. 76375405, Word Mark "NITRA".
An Appointment with Destiny—The Time for Web-Enabled Scheduling has Arrived, Link Fall ,2007 ,2 pages.
How a Solution found a Problem of Scheduling Service Appointments, Automotive News ,2016 ,4 pages.
IBM Tivoli Access Manager Base Administration Guide, Version 5.1. International Business Machines Corporation. Entire book enclosed and cited. ,2003 ,402 pgs.
NetFormx Offers Advanced Network Discovery Software, PR Newswire. Retrieved from highbeam.com/doc/1G1-54102907.html>. ,Mar. 15, 1999
Openbay Announces First-of-its-Kind Connected Car Repair Service, openbay.com ,Mar. 31, 2015 ,14 pages.
Service Advisor, Automotive Dealership Institute ,2007 ,26 pages.
xTime.com Web Pages, ,Jan. 8, 2015 ,1 page.
XTimes Newsletter, vol. 7 ,2013 ,4 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Dec. 26, 2008 ,13 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Feb. 6, 2006 ,11 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Jul. 22, 2009 ,22 pages.
U.S. Appl. No. 10/350,795, et al., Final Office Action ,dated Jul. 6, 2011 ,26 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Jun. 29, 2006 ,11 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Mar. 12, 2007 ,10 pages.
U.S. Appl. No. 10/350,795, et al., Final Office Action ,dated Mar. 3, 2010 ,24 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated May 29, 2008 ,10 pages.
U.S. Appl. No. 10/350,795, et al., Notice of Allowance ,dated May 7, 2012 ,15 pages.
U.S. Appl. No. 10/350,795, et al., Non-Final Office Action ,dated Nov. 1, 2010 ,19 pages.
U.S. Appl. No. 10/350,796, et al., Notice of Allowance ,dated Feb. 1, 2006 ,5 pages.
U.S. Appl. No. 10/350,796, et al., Non-Final Office Action ,dated May 19, 2005 ,7 pages.
U.S. Appl. No. 10/350,810, et al., Notice of Allowance ,dated Apr. 14, 2008 ,6 pages.
U.S. Appl. No. 10/350,810, et al., Non-Final Office Action ,dated Apr. 17, 2007 ,12 pages.
U.S. Appl. No. 10/350,810, et al., Final Office Action ,dated Apr. 5, 2005 ,12 pages.
U.S. Appl. No. 10/350,810, et al., Notice of Non-compliant Amendment ,dated Dec. 12, 2006.
U.S. Appl. No. 10/350,810, et al., Non-Final Office Action ,dated Dec. 9, 2005 ,14 pages.
U.S. Appl. No. 10/350,810, et al., Final Office Action ,dated May 18, 2006 ,15 pages.
U.S. Appl. No. 10/350,810, et al., Final Office Action ,dated Nov. 14, 2007 ,13 pages.
U.S. Appl. No. 10/350,810, et al., Non-Final Office Action ,dated Sep. 22, 2004 ,10 pages.
U.S. Appl. No. 10/351,465, et al., Non-Final Office Action ,dated Jul. 27, 2004 ,9 pages.
U.S. Appl. No. 10/351,465, et al., Final Office Action ,dated May 5, 2005 ,8 pages.
U.S. Appl. No. 10/351,465, et al., Notice of Allowance ,dated Sep. 21, 2005 ,4 pages.
U.S. Appl. No. 10/351,606, et al., Notice of Allowance ,dated Apr. 4, 2006 ,12 pages.
U.S. Appl. No. 10/351,606, et al., Non-final Office Action ,dated Dec. 19, 2005 ,7 pages.
U.S. Appl. No. 10/351,606, et al., Non-final Office Action ,dated May 17, 2004 ,5 pages.
U.S. Appl. No. 10/351,606, et al., Non-Final Office Action ,dated May 17, 2004 ,6 pages.
U.S. Appl. No. 13/025,019, et al., Non-Final Office Action ,dated Apr. 22, 2016 ,16 pages.
U.S. Appl. No. 13/025,019, et al., Non-Final Office Action ,dated Apr. 5, 2013 ,15 pages.
U.S. Appl. No. 13/025,019, et al., Final Office Action ,dated Aug. 28, 2015 ,25 pages.
U.S. Appl. No. 16/041,552, Non-Final Office Action, dated Sep. 17, 2020, 16 pages.
U.S. Appl. No. 13/025,019, et al., Final Office Action ,dated Jul. 13, 2018 ,11 pages.
U.S. Appl. No. 13/025,019, et al., Non-Final Office Action ,dated Oct. 6, 2017 ,17 pages.
U.S. Appl. No. 13/025,019, et al., Final Office Action ,dated Sep. 12, 2013 ,13 pages.
U.S. Appl. No. 13/025,019, et al., Non-Final Office Action ,dated Sep. 18, 2014 ,15 pages.
U.S. Appl. No. 13/025,019, et al., Notice of Allowance ,dated Sep. 26, 2019 ,9 pages.
Openbay.com web pages, Openbay.com, retrieved from archive.org on May 14, 2019, 2 pages.
Openbay.com Web Pages, Openbay.com, retrieved from archive.org, May 14, 2019, 11 pages.
Openbay.com Web Pages, Openbay.com, retrieved from archive.org May 14, 2019, 6 pages.
PubNub Staff, Streaming Vehicle Data in Realtime with Automatic (Pt 1), Pubnub.com, Aug. 17, 2015, 13 pages.
CNY Business Journal, Frank La Voila named Southern Tier Small-Business Person of 1999, Jun. 11, 1999, 2 pages.
Needham, Charlie, "Google Now Taking Appointments for Auto Repair Shops", Autoshopsolutions.com, Aug. 25, 2015, 6 pages.
U.S. Appl. No. 14/208,042, et al., Final Office Action ,dated Apr. 16, 2018.
U.S. Appl. No. 14/208,042, et al., Non-Final Office Action ,dated Aug. 21, 2020 ,13 pages.
U.S. Appl. No. 14/208,042, et al., Final Office Action ,dated Dec. 6, 2016 ,26 pages.
U.S. Appl. No. 14/208,042, et al., Final Office Action ,dated Jan. 11, 2019 ,16 pages.
U.S. Appl. No. 14/208,042, et al., Advisory Action ,dated Jul. 12, 2018.
U.S. Appl. No. 14/208,042, et al., Non-Final Office Action ,dated Jun. 30, 2016 ,23 pages.
U.S. Appl. No. 14/208,042, et al., Non-Final Office Action ,dated Sep. 20, 2017.
U.S. Appl. No. 14/208,042, et al., Non-Final Office Action ,dated Sep. 21, 2018.
U.S. Appl. No. 15/134,779, et al., Final Office Action ,dated Feb. 27, 2020 ,18 pages.
U.S. Appl. No. 15/134,779, et al., Non-Final Office Action ,dated Jan. 30, 2019 ,26 pages.
U.S. Appl. No. 15/134,779, et al., Advisory Action ,dated Jul. 29, 2019 ,6 pages.
U.S. Appl. No. 15/134,779, et al., Final Office Action ,dated May 17, 2019 ,25 pages.
U.S. Appl. No. 15/134,779, et al., Non-Final Office Action ,dated Nov. 19, 2019 ,27 pages.

(56) **References Cited**

OTHER PUBLICATIONS

U.S. Appl. No. 15/134,779, et al., Notice of Allowance ,dated Sep. 9, 2020 ,12 pages.
U.S. Appl. No. 15/134,793, et al., Non-Final Office Action ,dated Jan. 30, 2019 ,26 pages.
U.S. Appl. No. 15/134,793, et al., Advisory Action ,dated Jul. 29, 2019 ,6 pages.
U.S. Appl. No. 15/134,793, et al., Final Office Action ,dated Mar. 27, 2020 ,22 pages.
U.S. Appl. No. 15/134,793, et al., Final Office Action ,dated May 13, 2019 ,26 pages.
U.S. Appl. No. 15/134,793, et al., Non-Final Office Action ,dated Nov. 19, 2019 ,31 pages.
U.S. Appl. No. 15/134,793, et al., Notice of Allowance ,dated Nov. 2, 2020 ,13 pages.
U.S. Appl. No. 15/134,820, et al., Non-Final Office Action ,dated Feb. 23, 2018.
U.S. Appl. No. 15/134,820, et al., Notice of Allowance ,dated Jan. 28, 2019 ,7 pages.
U.S. Appl. No. 15/134,820, et al., Final Office Action ,dated Sep. 21, 2018.
U.S. Appl. No. 15/478,042, et al., Non-Final Office Action ,dated Aug. 4, 2020 ,42 pages.
U.S. Appl. No. 15/478,042, et al., Final Office Action ,dated Mar. 19, 2020 ,35 pages.
U.S. Appl. No. 15/478,042, et al., Non-Final Office Action ,dated Oct. 10, 2019 ,26 pages.
U.S. Appl. No. 15/478,048, et al., Final Office Action ,dated Apr. 9, 2020 ,42 pages.
U.S. Appl. No. 15/478,048, et al., Non-Final Office Action ,dated Sep. 30, 2019 ,30 pages.
U.S. Appl. No. 15/602,999, et al., Notice of Allowance ,dated Apr. 18, 2019 ,6 pages.
U.S. Appl. No. 15/602,999, et al., Advisory Action ,dated Jan. 31, 2019 ,3 pages.
U.S. Appl. No. 15/602,999, et al., Non-Final Office Action ,dated May 3, 2018.
U.S. Appl. No. 15/602,999, et al., Final Office Action ,dated Nov. 21, 2018.
U.S. Appl. No. 16/041,552, et al., Non-Final Office Action ,dated Dec. 27, 2019 ,13 pages.
U.S. Appl. No. 16/041,552, et al., Final Office Action ,dated May 29, 2020 ,18 pages.
Aloisio,Giovanni et al.,Web-based access to the Grid using the Grid Resource Broker portal, Google ,2002 , pp. 1145-1160.
Bedell,Doug et al., Dallas Morning News, "I Know Someone Who Knows Kevin Bacon". Oct. 27, 1998. 4 pgs.
Chadwick,D.W. et al., Understanding X.500—The Directory, Available at <http://sec.cs.kent.ac.uk/x500book/>. Entire work cited. ,1996.
Chatterjee,Pallab et al.,On-board diagnostics not just for racing anymore, EDN.com ,May 6, 2013 ,7 pages.
Chen,Deren et al., Business to Business Standard and Supply Chain System Framework in Virtual Enterprises, Computer Supported Cooperative Work in Design, The Sixth International Conference on 2001 ,pp. 472-476.
Croswell,Wayne et al., Service Shop Optimiztion, Modern Tire Retailer ,May 21, 2013 ,7 pages.
Davis,Peter T. et al., Sams Teach Yourself Microsoft Windows NT Server 4 in 21 Days, Sams® Publishing, ISBN: 0-672-31555-6 ,1999, printed Dec. 21, 2008 ,15 pages.
Derfler,Frank J. et al., How Networks Work: Millennium Edition, Que, A Division of Macmillan Computer Publishing, ISBN: 0-7897-2445-6 ,2000 ,9 pages.
Drawbaugh,Ben et al.,Automatic Link Review: an expensive way to learn better driving habits, Endgadget.com , Nov. 26, 2013 ,14 pages.
Emmanuel,Daniel et al.,Basics to Creating an Appointment System for Automotive Service Customers, Automotiveservicemanagement.com ,2006 ,9 pages.
Hogue, et al.,Thresher: Automating the Unwrapping of Semantic Content from the World Wide Web, ACM ,2005 , pp. 86-95.
Housel,Barron C. et al.,WebExpress: A client/intercept based system for optimizing Web browsing in a wireless environment, Google ,1998 ,pp. 419-431.
Jenkins,Will et al.,Real-time vehicle performance monitoring with data intergrity, A Thesis Submitted to the Faculty of Mississippi State University ,Oct. 2006 ,57 pages.
Lavrinc,Damon et al.,First Android-powered infotainment system coming to 2012 Saab 9-3, Autoblog.com ,Mar. 2, 2011 ,8 pages.
Lee,Adam J. et al.,Searching for Open Windows and Unlocked Doors: Port Scanning in Large-Scale Commodity Clusters, Cluster Computing and the Grid, 2005. IEEE International Symposium on vol. 1 ,2005 ,pp. 146-151.
Michener,J.R. et al.,Managing System and Active-Content Integrity, Computer; vol. 33, Issue: 7 ,2000 ,pp. 108-110.
Milic-Frayling,Natasa et al.,SmartView: Enhanced Document Viewer for Mobile Devices, Google ,Nov. 15, 2002 ,11 pages.
Phelan,Mark et al.,Smart phone app aims to automate car repairs, Detroit Free Press Auto Critic ,Mar. 31, 2015 ,2 pages.
Strebe,Matthew et al., MCSE: NT Server 4 Study Guide, Third Edition. SYBEX Inc. Front matter ,2000 ,pp. 284-293, and 308-347.
Warren,Tamara et al.,This Device Determines What Ails Your Car and Finds a Repair Shop—Automatically, CarAndDriver.com ,Apr. 8, 2015 ,7 pages.
You,Song et al.,Overview of Remote Diagnosis and Maintenance for Automotive Systems, 2005 SAE World Congress ,Apr. 11-14, 2015 ,10 pages.

* cited by examiner

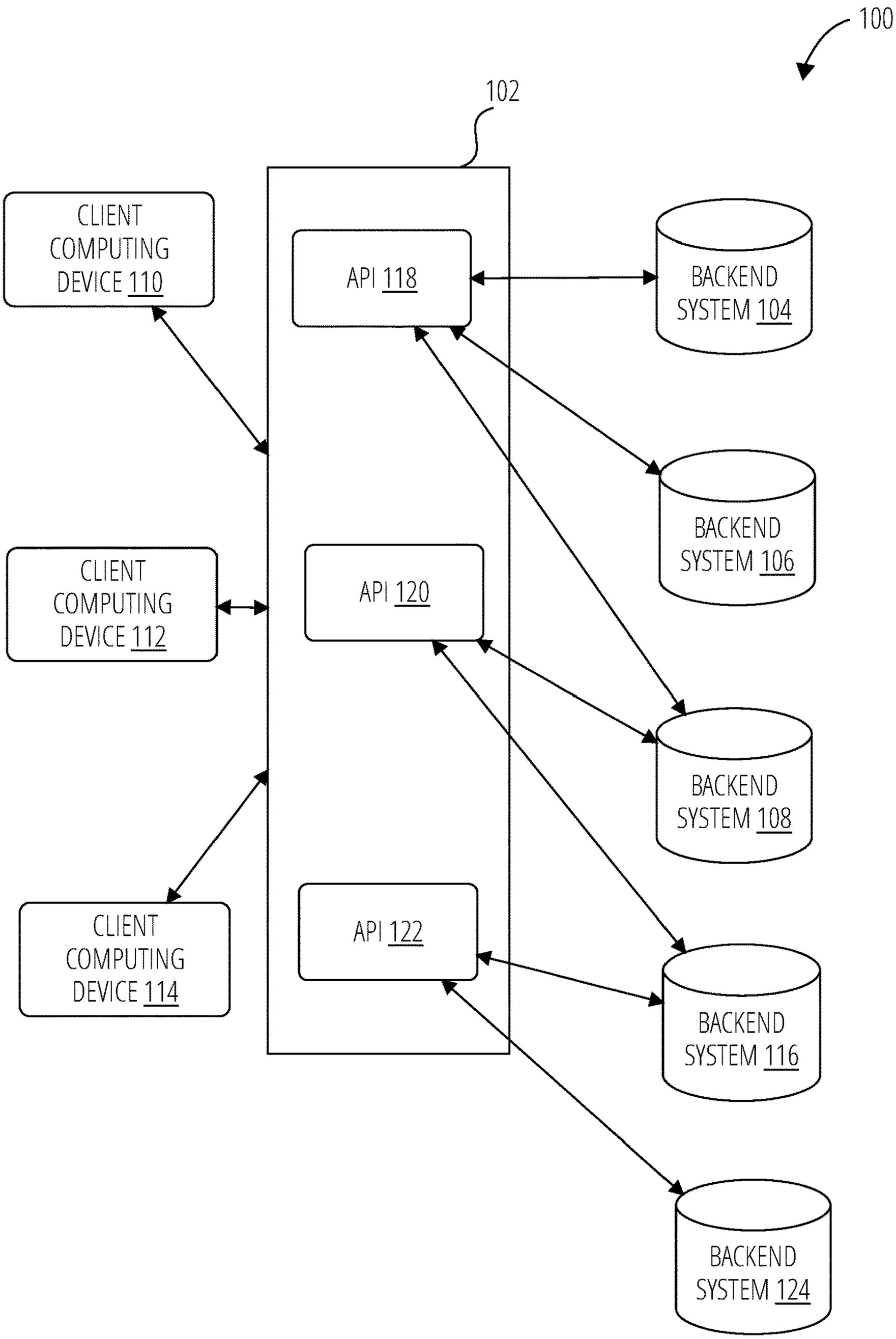

100
102
CLIENT COMPUTING DEVICE 110
CLIENT COMPUTING DEVICE 112
CLIENT COMPUTING DEVICE 114
API 118
API 120
API 122
BACKEND SYSTEM 104
BACKEND SYSTEM 106
BACKEND SYSTEM 108
BACKEND SYSTEM 116
BACKEND SYSTEM 124

FIG. 1

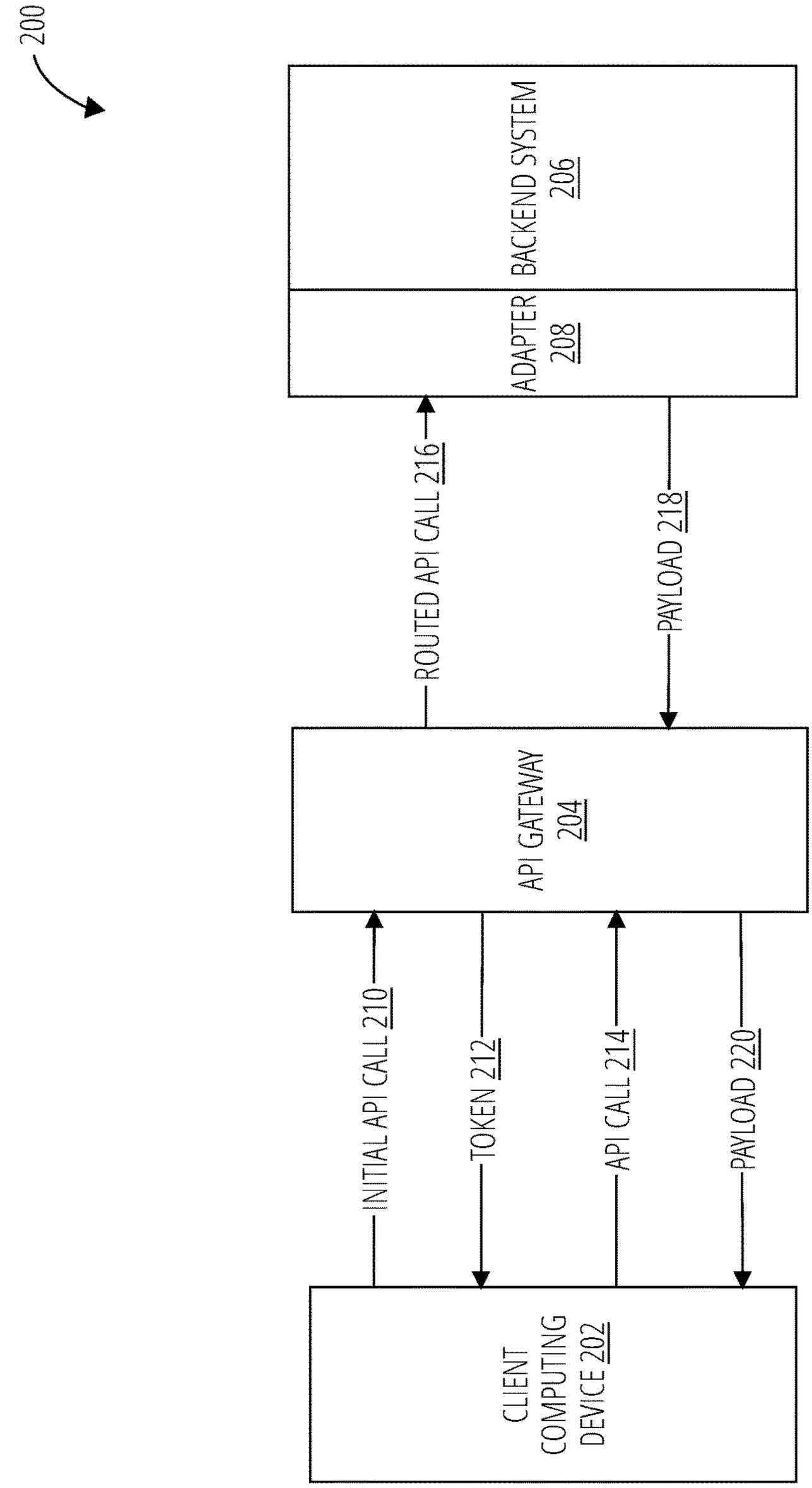

200
CLIENT COMPUTING DEVICE 202
API GATEWAY 204
BACKEND SYSTEM 206
ADAPTER 208
INITIAL API CALL 210
TOKEN 212
API CALL 214
PAYLOAD 220
ROUTED API CALL 216
PAYLOAD 218

FIG. 2

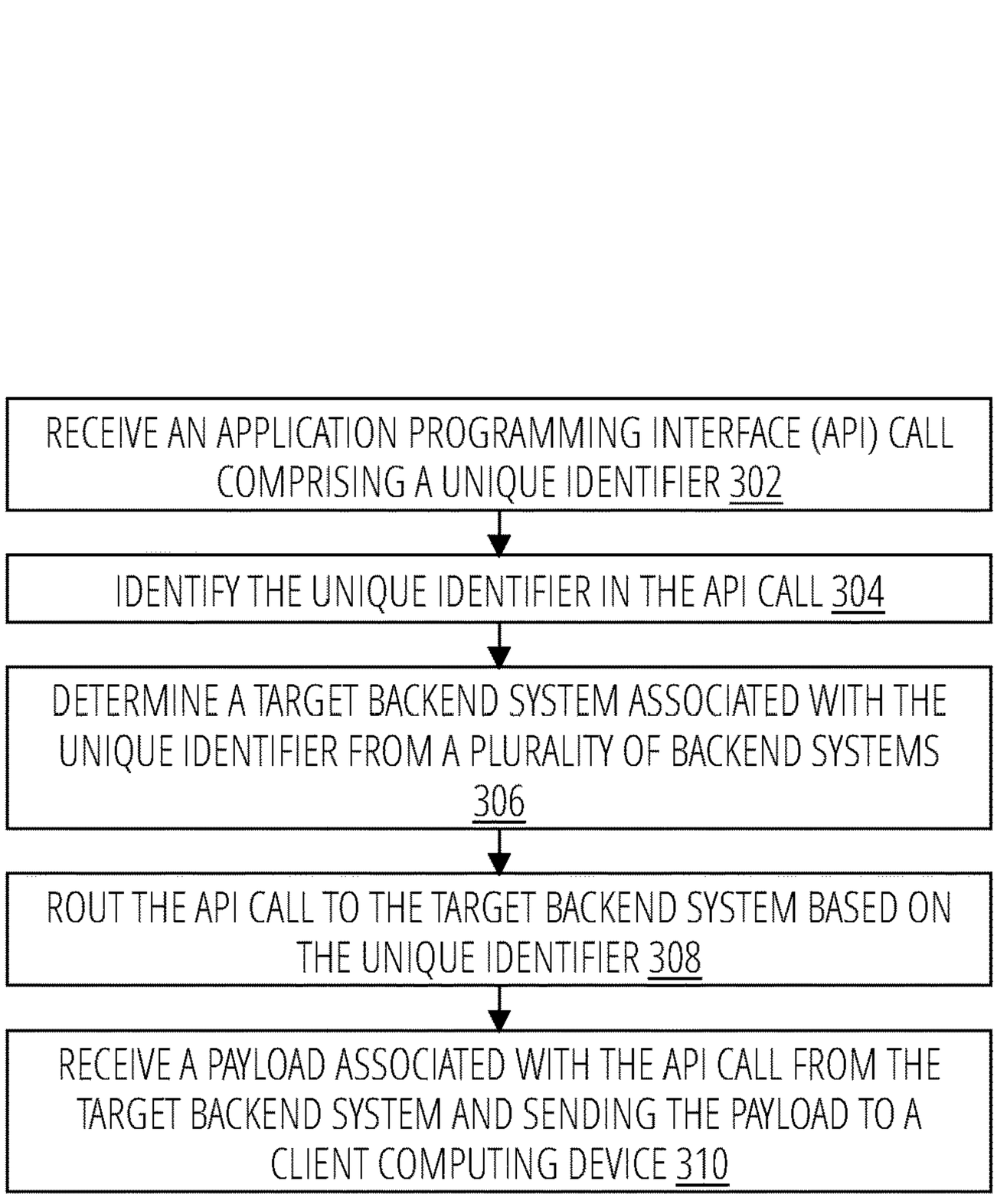

300
RECEIVE AN APPLICATION PROGRAMMING INTERFACE (API) CALL COMPRISING A UNIQUE IDENTIFIER 302
IDENTIFY THE UNIQUE IDENTIFIER IN THE API CALL 304
DETERMINE A TARGET BACKEND SYSTEM ASSOCIATED WITH THE UNIQUE IDENTIFIER FROM A PLURALITY OF BACKEND SYSTEMS 306
ROUT THE API CALL TO THE TARGET BACKEND SYSTEM BASED ON THE UNIQUE IDENTIFIER 308
RECEIVE A PAYLOAD ASSOCIATED WITH THE API CALL FROM THE TARGET BACKEND SYSTEM AND SENDING THE PAYLOAD TO A CLIENT COMPUTING DEVICE 310

FIG. 3

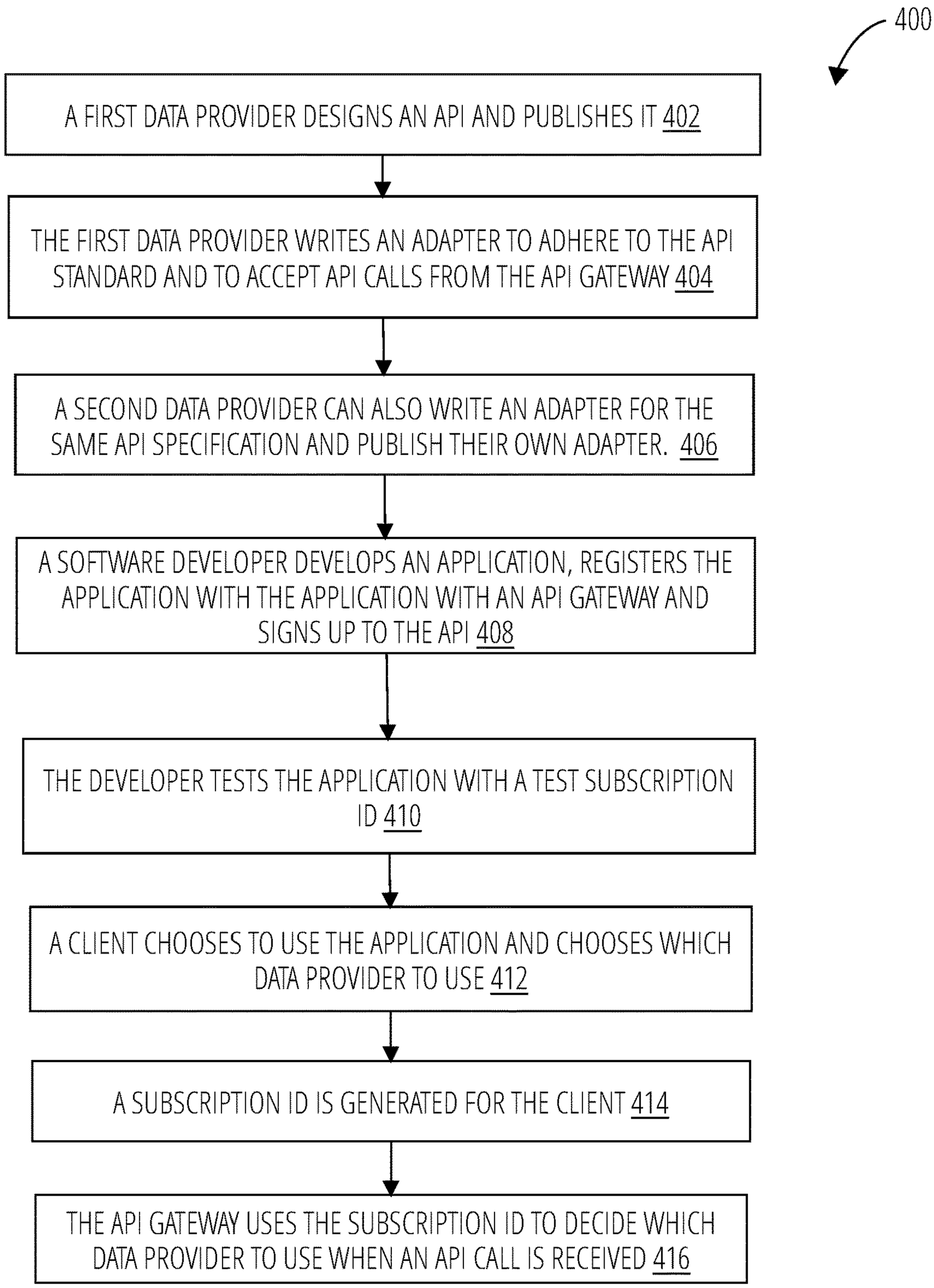

400
A FIRST DATA PROVIDER DESIGNS AN API AND PUBLISHES IT 402
THE FIRST DATA PROVIDER WRITES AN ADAPTER TO ADHERE TO THE API STANDARD AND TO ACCEPT API CALLS FROM THE API GATEWAY 404
A SECOND DATA PROVIDER CAN ALSO WRITE AN ADAPTER FOR THE SAME API SPECIFICATION AND PUBLISH THEIR OWN ADAPTER. 406
A SOFTWARE DEVELOPER DEVELOPS AN APPLICATION, REGISTERS THE APPLICATION WITH THE APPLICATION WITH AN API GATEWAY AND SIGNS UP TO THE API 408
THE DEVELOPER TESTS THE APPLICATION WITH A TEST SUBSCRIPTION ID 410
A CLIENT CHOOSES TO USE THE APPLICATION AND CHOOSES WHICH DATA PROVIDER TO USE 412
A SUBSCRIPTION ID IS GENERATED FOR THE CLIENT 414
THE API GATEWAY USES THE SUBSCRIPTION ID TO DECIDE WHICH DATA PROVIDER TO USE WHEN AN API CALL IS RECEIVED 416

FIG. 4

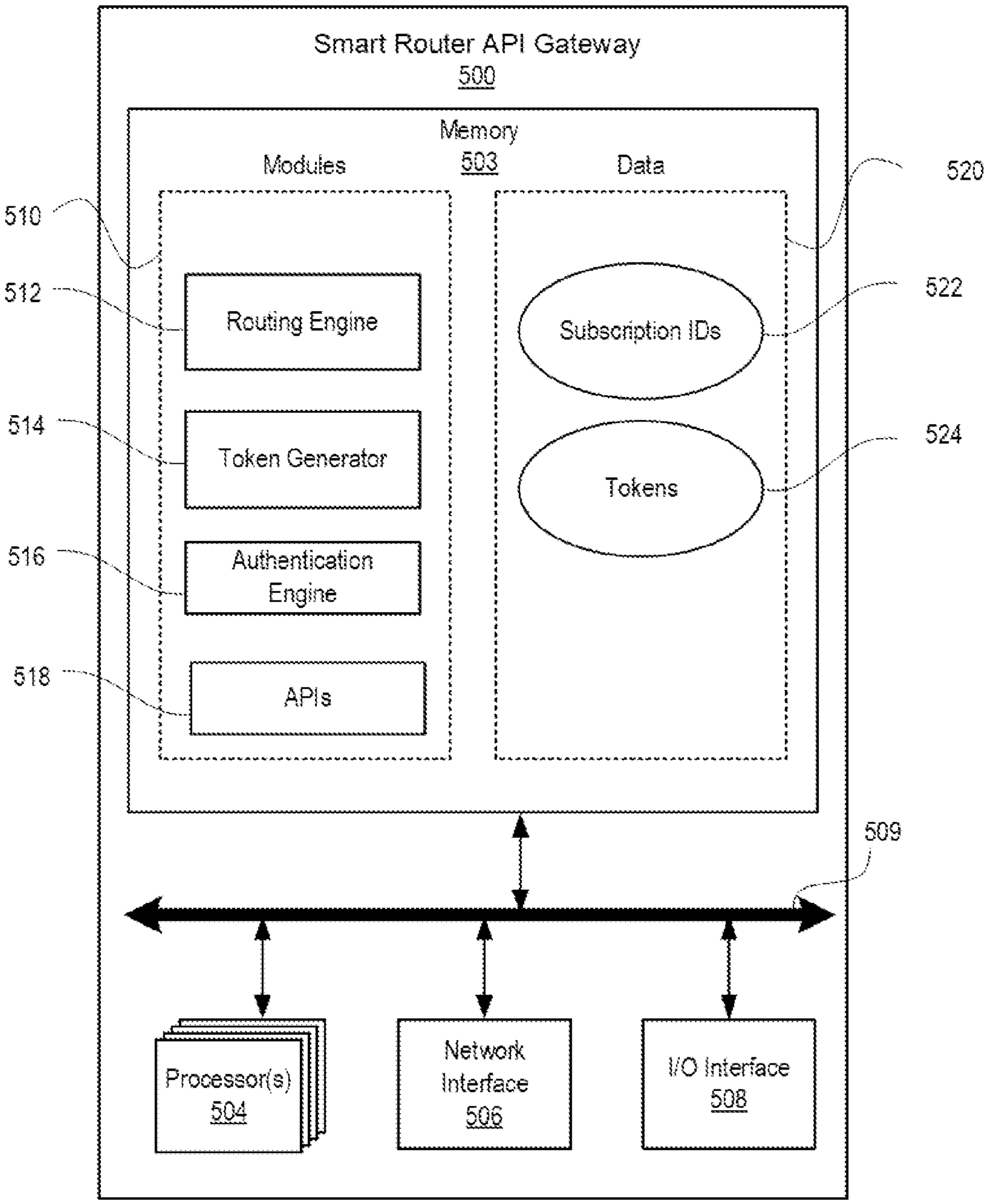

Smart Router API Gateway
500
Memory
503
Modules
Data
510
512
514
516
518
520
522
524
Routing Engine
Token Generator
Authentication Engine
APIs
Subscription IDs
Tokens
509
Processor(s)
504
Network Interface
506
I/O Interface
508

FIG. 5

SYSTEMS, METHODS, AND APPARATUSES FOR ROUTING API CALLS

TECHNICAL FIELD

The present disclosure relates generally to handling API calls. More specifically, the present disclosure relates to methods, systems and apparatuses for routing API calls to multiple backend systems that share a common API.

BRIEF DESCRIPTION OF THE SEVERAL VIEWS OF THE DRAWINGS

To easily identify the discussion of any particular element or act, the most significant digit or digits in a reference number refer to the figure number in which that element is first introduced.

FIG. **1** illustrates a block diagram of an API call routing system **100** in accordance with one embodiment.

FIG. **2** illustrates a simplified signal flow diagram **200** for a smart routing API gateway **204** in accordance with one embodiment.

FIG. **3** illustrates a method **300** to route an API call in accordance with one embodiment.

FIG. **4** illustrates a method **400** to create and implement an API common to multiple backend systems in accordance with one embodiment.

FIG. **5** is a block diagram of a smart router API gateway smart router API gateway **500** according to one embodiment.

DETAILED DESCRIPTION

Described herein are embodiments of systems, apparatuses, and methods for routing Application Programming Interface (API) calls using a common API to multiple backend systems. An API gateway is a way to connect various developers or applications to a backend system. Traditional API gateways use an API to connect a client competing device to services of a single backend system. Unlike traditional API gateways, the embodiments herein include smart routing API gateways that can reuse a single API for to connect multiple different applications and clients to multiple different backend systems.

Using a common API to connect multiple applications to multiple backend systems can lead to greater computing efficiencies. For instance, the traditional API gateway can receive API calls from many client computing devices and routes them to a single backend system. However, this means that for each backend system, the developer would have to develop multiple integrations of an API if it was desired to use the API with multiple backend systems. In contrast, the smart routing API gateway is capable of connecting many client computing devices and applications to many backend systems. This allows a developer to develop a single API that can be used to access multiple backend systems. Thus, with a smart routing API gateway fewer application integrations would need to be developed.

In some embodiments herein, an API gateway may receive an API call comprising a unique identifier. The API gateway may identify the unique identifier in the API call and determine a target backend system associated with the unique identifier from a plurality of backend systems. The API gateway may then route the API call to the target backend system based on the unique identifier.

The phrases "coupled to," "connected to," and "in communication with" refer to any form of interaction between

two or more components, including mechanical, electrical, magnetic, and electromagnetic interaction. Two components may be connected to each other, even though they are not in direct contact with each other, and even though there may be intermediary devices between the two components.

It will be readily understood that the components of the embodiments as generally described below and illustrated in the Figures herein could be arranged and designed in a wide variety of different configurations. For instance, the steps of a method do not necessarily need to be executed in any specific order, or even sequentially, nor do the steps need to be executed only once. Thus, the following more detailed description of various embodiments, as described below and represented in the Figures, is not intended to limit the scope of the disclosure but is merely representative of various embodiments. While the various aspects of the embodiments are presented in the drawings, the drawings are not necessarily drawn to scale unless specifically indicated.

Embodiments and implementations of systems and methods described herein may include various steps, which may be embodied in machine-executable instructions to be executed by a computer system. A computer system may include one or more general-purpose or special-purpose computers (or other electronic devices). The computer system may include hardware components that include specific logic for performing the steps or may include a combination of hardware, software, and/or firmware.

Embodiments may be provided as a computer program product including a computer-readable medium having stored thereon instructions that may be used to program a computer system or other electronic device to perform the processes described herein. The computer-readable medium may include, but is not limited to: hard drives, floppy diskettes, optical disks, CD-ROMs, DVD-ROMs, ROMs, RAMs, EPROMs, EEPROMs, magnetic or optical cards, solid-state memory devices, or other types of media/computer-readable media suitable for storing electronic instructions.

Computer systems and the computers in a computer system may be connected via a network. Suitable networks for configuration and/or use as described herein include one or more local area networks, wide area networks, metropolitan area networks, and/or Internet or IP networks, such as the World Wide Web, a private Internet, a secure Internet, a value-added network, a virtual private network, an extranet, an intranet, or even stand-alone machines which communicate with other machines by physical transport of media. In particular, a suitable network may be formed from parts or entireties of two or more other networks, including networks using disparate hardware and network communication technologies.

One suitable network includes a server and several clients; other suitable networks may contain other combinations of servers, clients, and/or peer-to-peer nodes, and a given computer system may function both as a client and as a server. Each network includes at least two computers or computer systems, such as the server and/or clients. A computer system may include a workstation, laptop computer, disconnectable mobile computer, server, mainframe, cluster, so-called "network computer" or "thin client," tablet, smart phone, personal digital assistant or other hand-held computing device, "smart" consumer electronics device or appliance, medical device, or a combination thereof.

Suitable networks may include communications or networking software, such as the software available from Novell®, Microsoft®, and other vendors, and may operate using TCP/IP, SPX, IPX, and other protocols over twisted

pair, coaxial, or optical fiber cables; telephone lines; radio waves; satellites; microwave relays; modulated AC power lines; physical media transfer; and/or other data transmission "wires" known to those of skill in the art. The network may encompass smaller networks and/or be connectable to other networks through a gateway or similar mechanism.

Each computer system includes one or more processors and/or memory; computer systems may also include various input devices and/or output devices. The processor may include a general-purpose device, such as an Intel®, AMD®, or other "off-the-shelf" microprocessor. The processor may include a special-purpose processing device, such as an ASIC, SoC, SiP, FPGA, PAL, PLA, FPLA, PLD, or other customized or programmable device. The memory may include static RAM, dynamic RAM, flash memory, one or more flip-flops, ROM, CD-ROM, disk, tape, magnetic, optical, or other computer storage medium. The input device(s) may include a keyboard, mouse, touch screen, light pen, tablet, microphone, sensor, or other hardware with accompanying firmware and/or software. The output device(s) may include a monitor or other display, printer, speech or text synthesizer, switch, signal line, or other hardware with accompanying firmware and/or software.

The computer systems may be capable of using a floppy drive, tape drive, optical drive, magneto-optical drive, or other means to read a storage medium. A suitable storage medium includes a magnetic, optical, or other computer-readable storage device having a specific physical configuration. Suitable storage devices include floppy disks, hard disks, tape, CD-ROMs, DVDs, PROMs, RAM, flash memory, and other computer system storage devices. The physical configuration represents data and instructions which cause the computer system to operate in a specific and predefined manner as described herein.

Suitable software to assist in implementing the invention is readily provided by those of skill in the pertinent art(s) using the teachings presented here and programming languages and tools, such as JavaScript, Modern Fortran, Java, Pascal, C++, C, PHP, .Net, database languages, APIs, SDKs, assembly, firmware, microcode, and/or other languages and tools. Suitable signal formats may be embodied in analog or digital form, with or without error detection and/or correction bits, packet headers, network addresses in a specific format, and/or other supporting data readily provided by those of skill in the pertinent art(s).

Aspects of certain embodiments may be implemented as software modules or components. As used herein, a software module or component may include any type of computer instruction or computer executable code located within or on a computer-readable storage medium. A software module may, for instance, comprise one or more physical or logical blocks of computer instructions, which may be organized as a routine, program, object, component, data structure, etc., that performs one or more tasks or implement particular abstract data types. A particular software module may comprise disparate instructions stored in different locations of a computer-readable storage medium, which together implement the described functionality of the module. Indeed, a module may comprise a single instruction or many instructions, and may be distributed over several different code segments, among different programs, and across several computer-readable storage media.

Some embodiments may be practiced in a distributed computing environment where tasks are performed by a remote processing device linked through a communications network. In a distributed computing environment, software modules may be located in local and/or remote computer-readable storage media. In addition, data being tied or rendered together in a database record may be resident in the same computer-readable storage medium, or across several computer-readable storage media, and may be linked together in fields of a record in a database across a network. According to one embodiment, a database management system (DBMS) allows users to interact with one or more databases and provides access to the data contained in the databases.

FIG. **1** illustrates a block diagram of an API call routing system **100** in accordance with one embodiment. As shown, the API call routing system **100** may include a plurality of client computing devices (e.g., first client computing device **110**, second client computing device **112**, and third client computing device **114**), an API gateway **102**, and a plurality of backend systems (e.g., first backend system **104**, second backend system **106**, third backend system **108** fourth backend system **116**, and fifth backend system **124**).

The client computing devices may be configured for a variety of clients. For example, the client computing devices may be used for a plurality of different car dealerships. Each client may use one or more applications for their business. Therefore, each client computing device may have one or more applications. The applications may include applications related to finances, inventory management, contact management, and scheduling management. The client computing devices may communicate with the API gateway **102**. For example, the client computing devices may make API calls to the API gateway **102** and receive payloads associated with the calls.

The API calls may be a request by an application on a client computing device for information from one of the backend systems. The backend systems may store information and provide one or more services. The backend systems may be separately maintained systems that do not communicate directly with one another. In some embodiments, the backend systems may be managed by different companies. The backend systems may be controlled by one or more data providers. For example, the backend systems may be car dealer management system, a statistic provider, an insurance company, etc.

As shown, the API gateway **102** may route API calls from the client computing devices to the appropriate backend system using one of the APIs (e.g., first API **118**, second API **120**, and third API **122**). As shown, some APIs may be capable of communicating with multiple databases. Thus, an API call from a client computing device may correspond to an API that is common to multiple backend systems.

Accordingly, when the API gateway **102** receives an API call, the associated API may determine the proper backend system to route the call too. In some embodiments, the API call routing system **100** may use unique identifiers in the API call to indicate which backend system to use. The unique identifiers may be subscription identifiers that are unique to an application, a client, or a combination of the application for a client. In some embodiments, the unique identifiers may be part of the API header. In some embodiments, the unique identifiers may be part of the API payload. In some embodiments, the unique identifiers may be a universally unique identifier (UUID) or a globally unique identifier (GUID). The unique identifiers may be 24 bytes or 36 bytes.

FIG. **2** illustrates a simplified signal flow diagram **200** for a smart routing API gateway **204** in accordance with one embodiment. As shown, the API gateway **204** may use token-based security to prevent unauthorized access to the

multiple backend systems in communication with the API gateway **204**. For example, the API gateway **204** may use OAUTH security.

The client computing device **202** may send an initial API call **210** to the API gateway **204**. The initial API call **210** may be sent when a client is setting up an application. The initial API call **210** may initiate interaction between the client computing device **202** and the API gateway **204** and be used to receive a token **212**. The token may be used to provide authorization of future API calls. For example, the token may be issued to determine what application and client has authority to access a data source (e.g., backend system **206**).

The client computing device **202** may send an API call **214** to the API gateway **204**. The API call **214** may include a unique identifier such as a subscription identifier for the client and application. The client computing device **202** may also send the token with the API call **214**. The API gateway **204** may check that the token is still authorized for the application and client that sent the API call **214**. If the API call **214** is authorized to proceed, the API gateway **204** may determine the unique identifier in the API call **214** and determine which backend system to route the API call **214**.

In the illustrated embodiment, the API gateway **204** determines that the unique identifier is associated with the backend system **206**. Accordingly, the API gateway **204** sends a routed API call **216** to the backend system **206**. An adapter **208** formats the routed API call **216** for the backend system **206**. The backend system **206** responds to the routed API call **216** by sending a payload **218** to the API gateway **204**. The API gateway **204** may forward the payload **220** to the client computing device **202**.

FIG. **3** illustrates a method **300** to route an API call in accordance with one embodiment. A system implementing the method **300** may receive **302** an API call comprising a unique identifier. The system may identify **304** the unique identifier in the API call. The unique identifier may be a subscription identifier unique to an application and a client. In some embodiments, the unique identifier may be in the header of the API call. In some embodiments, the unique identifier may be in the payload of the API call.

The system may determine **306** a target backend system associated with the unique identifier from a plurality of backend systems. The API call may correspond to an API that is common to multiple backend systems communicatively coupled with the router. Accordingly, the system may determine how to route the API call based on the unique identifier.

The system may route **308** the API call to the target backend system based on the unique identifier. The target backend system may be one of a dealer management system, a statistic provider, or an insurance company. In some embodiments, the backend systems that are associated with the API may be from different data providers. The system may receive **310** a payload associated with the API call from the target backend system and send the payload to a client computing device. In some embodiments, the system may receive a token with the API call and check that the token is valid for the unique identifier of the API call.

FIG. **4** illustrates a method **400** to create and implement an API common to multiple backend systems in accordance with one embodiment. In the method **400**, a first data provider designs **402** an API and publishes it. The data provider may be an automobile dealer management system, statistic provider, or an insurance company.

This API may be used by other data providers for their backend systems. For example, a second data provider can also write **406** an adapter for the same API specification and publish their own adapter. Using a common API for multiple data providers or multiple backend systems allows for fewer APIs which may assist the data providers and software developers as there are fewer APIs needed to be developed and applications will not have to be written for multiple APIs. Additionally, this may provide a client with a choice of providers for the data.

In the method **400**, a software developer develops **408** an application, registers the application with an API gateway, and signs up to the API. The software developer may test **410** the application with a test subscription ID. A client may choose **412** to use the application and choose which data provider to use **412**.

A subscription ID may be generated **414** for the client for the application. The API gateway may use **416** the subscription ID to decide which data provider to use when an API call is received. Thus, the API gateway serves as a smart router to route API calls to a correct backend system and data provider. This means that multiple data providers can be accessed by the application without the software developer writing another specific integration of the application.

FIG. **5** is a block diagram of a smart router API gateway smart router API gateway **500** according to one embodiment. The smart router API gateway **500** may perform the methods and use the techniques described with reference to the other figures in the specification. The smart router API gateway **500** can include a memory **503**, one or more processors **504**, a network interface **506**, an input/output interface **508**, and a system bus **509**.

The one or more processors **504** may include one or more general purpose devices, such as an Intel®, AMD®, or other standard microprocessor. The one or more processors **504** may include a special purpose processing device, such as ASIC, SoC, SiP, FPGA, PAL, PLA, FPLA, PLD, or other customized or programmable device. The one or more processors **504** can perform distributed (e.g., parallel) processing to execute or otherwise implement functionalities of the presently disclosed embodiments. The one or more processors **504** may run a standard operating system and perform standard operating system functions. It is recognized that any standard operating systems may be used, such as, for example, Microsoft® Windows®, Apple® MacOS®, Disk Operating System (DOS), UNIX, IRJX, Solaris, SunOS, FreeBSD, Linux®, ffiM® OS/2® operating systems, and so forth.

The memory **503** may include static RAM, dynamic RAM, flash memory, one or more flip-flops, ROM, CD-ROM, DVD, disk, tape, or magnetic, optical, or other computer storage medium. The memory **503** may include a plurality of program modules **510** and program data **520**. The memory **503** may be local to the smart router API gateway **500**, as shown, or may be distributed and/or remote relative to the smart router API gateway **500**.

Data generated or used by the smart router API gateway **500**, such as by the program modules **510** or other modules, may be stored on the memory **503**, for example, as stored program data **520**. The data **520** may be organized as one or more databases.

The data **520** may include subscription IDs **522** and tokens **524**. The subscription IDs **522** may be unique identifiers for an application, a client, or a combination of the application and client. The subscription ID may be assigned per application and client during a setup process of the application. The smart router API gateway **500** may associate the subscription ID with a backend system that the client indicated. The smart router API gateway **500** may

route API calls to the indicated backend system. The tokens **524** may be used to authorize access to backend systems for applications and clients.

The program modules **510** may run multiple operations concurrently or in parallel by or on the one or more processors **504**. In some embodiments, portions of the disclosed modules, components, and/or facilities are embodied as executable instructions embodied in hardware or firmware, or stored on a non-transitory, machine-readable storage medium. The executable instructions may comprise computer program code that, when executed by a processor and/or computing device, cause a computing system to implement certain processing steps, procedures, and/or operations, as disclosed herein. The modules, components, and/or facilities disclosed herein may be implemented and/or embodied as a driver, a library, an interface, an API, FPGA configuration data, firmware (e.g., stored on an EEPROM), and/or the like. In some embodiments, portions of the modules, components, and/or facilities disclosed herein are embodied as machine components, such as general and/or application-specific devices, including, but not limited to: circuits, integrated circuits, processing components, interface components, hardware controller(s), storage controller(s), programmable hardware, FPGAs, ASICs, and/or the like. Accordingly, the modules disclosed herein may be referred to as controllers, layers, services, engines, facilities, drivers, circuits, subsystems, and/or the like.

The modules **510** may comprise a routing engine **512**, a token generator **514**, an authentication engine **516**, and one or more APIs **518**. The routing engine **512** may be used to route API calls to a correct backend system based on the subscription ID within the API call. The token generator **514** and authentication engine **516** may be used to determine authorization of the API calls before accessing a backend system. The one or more APIs may be developed by data providers to access backend systems. An API may be common to multiple data providers and/or backend systems.

The input/output interface **508** may facilitate user interaction with one or more input devices and/or one or more output devices. The input device(s) may include a keyboard, mouse, touchscreen, light pen, tablet, microphone, sensor, or other hardware with accompanying firmware and/or software. The output device(s) may include a monitor or other display, printer, speech or text synthesizer, switch, signal line, or other hardware with accompanying firmware and/or software. For example, in one embodiment, the input/output interface **508** comprises a display to provide a graphical user interface (GUI) illustrating the potential ablation perimeters. The input/output interface **508** can receive the user input data **522**. In some embodiments, the input/output interface **508** is a touchscreen, and the size input is received via the touchscreen. In some embodiments, the input/output interface **508** can superimpose the target ablation perimeters on an image of the tissue.

The network interface **506** may facilitate communication with other computing devices and/or networks and/or other computing and/or communications networks. The network interface **506** may be equipped with conventional network connectivity, such as, for example, Ethernet (IEEE 1102.3), Token Ring (IEEE 1102.5), Fiber Distributed Datalink Interface (FDDI), or Asynchronous Transfer Mode (ATM). Further, the network interface **506** may be configured to support a variety of network protocols such as, for example, Internet Protocol (IP), Transfer Control Protocol (TCP), Network File System over UDP/TCP, Server Message Block (SMB), Microsoft® Common Internet File System (CIFS), Hypertext Transfer Protocols (HTTP), Direct Access File System (DAFS), File Transfer Protocol (FTP), Real-Time Publish Subscribe (RTPS), Open Systems Interconnection (OSI) protocols, Simple Mail Transfer Protocol (SMTP), Secure Shell (SSH), Secure Socket Layer (SSL), and so forth.

The system bus **509** may facilitate communication and/or interaction between the other components of the smart router API gateway **500**, including the one or more processors **504**, the memory **503**, the input/output interface **508**, and the network interface **506**.

Any methods disclosed herein comprise one or more steps or actions for performing the described method. The method steps and/or actions may be interchanged with one another. In other words, unless a specific order of steps or actions is required for proper operation of the embodiment, the order and/or use of specific steps and/or actions may be modified.

While specific embodiments of stents have been illustrated and described, it is to be understood that the disclosure provided is not limited to the precise configuration and components disclosed. Various modifications, changes, and variations apparent to those of skill in the art having the benefit of this disclosure may be made in the arrangement, operation, and details of the methods and systems disclosed, with the aid of the present disclosure.

Without further elaboration, it is believed that one skilled in the art can use the preceding description to utilize the present disclosure to its fullest extent. The examples and embodiments disclosed herein are to be construed as merely illustrative and exemplary and not a limitation of the scope of the present disclosure in any way. It will be apparent to those having skill, having the benefit of this disclosure, in the art that changes may be made to the details of the above-described embodiments without departing from the underlying principles of the disclosure herein.

What is claimed is:

1. A method to route an API call, the method comprising: connecting a plurality of clients to a plurality of backend systems via an Application Programming Interface (API) gateway comprising a common API that is used by multiple of the plurality of backend systems, wherein connecting comprises: registering an application on one of the plurality of clients with the common API on the API gateway; receiving an indication of a target backend system that the application is to access using the common API, wherein the target backend system is one of the plurality of backend systems using the common API; assigning a unique identifier to the application; and associating the unique identifier with the target backend system; receiving, at the common API gateway, an API call comprising a unique identifier from the assigned unique identifiers; identifying the unique identifier in the API call; determining, via the common API, the target backend system associated with the unique identifier from the plurality of backend systems; and routing, via the common API, the API call to the target backend system based on the unique identifier;

wherein the unique identifier is within a header of the API call,

receiving a token with the API call and checking that the token is valid for the unique identifier of the API call.

2. The method of claim **1**, wherein the API call corresponds to the common API that is common to multiple backend systems communicatively coupled with the API gateway.

3. The method of claim **1**, wherein the unique identifier is a subscription identifier unique to an application and a client.

4. The method of claim **1**, wherein the target backend system is implemented by one of a plurality of data providers using the common API.

5. The method of claim 1, further comprising receiving a payload associated with the API call from the target backend system and sending the payload to a client computing device.

6. An API gateway comprising: an interface to communicate with a plurality of client computing devices comprising one or more applications and a plurality of backend systems; memory to store one or more APIs and one or more processors configured to: register each of the one or more applications with a corresponding API of the one or more APIs, wherein at least one of the one or more APIs is common to multiple backend systems; receive an indication of a target backend system for applications registered with an API common to multiple backend systems; assign unique identifiers to each application of the one or more applications on the plurality of client computing devices; associate each of the unique identifiers with one of the plurality of backend systems; receive an API call comprising a unique identifier from a client computing device; identify the unique identifier in the API call determine, via an API associated with the API call, the target backend system associated with the unique identifier from the plurality of backend systems; and route, via the API associated with the API call, the API call to the target backend system based on the unique identifier;

wherein the unique identifier is within a header of the API call,

comprising receiving a token with the API call and checking that the token is valid for the unique identifier of the API call.

7. The API gateway of claim 6, wherein the API call corresponds to an API that is common to multiple backend systems communicatively coupled with the API gateway.

8. The API gateway of claim 6, wherein the unique identifier is a subscription identifier unique to an application and a client.

9. The API gateway of claim 6, wherein the target backend system is implemented by one of a plurality of data providers using a common API.

10. The API gateway of claim 6, wherein the one or more processors are further configured to receive a payload associated with the API call from the target backend system and send the payload to a client computing device.

11. An API call router comprising: memory to store an API associated with more than one backend system; one or more processors configured to: register an application on one of a plurality of clients with a common API that is used by multiple backend systems, receive an indication of a target backend system that the application is to access using the common API, wherein the target backend system is one of the multiple backend systems using the common API; assign a unique identifer to the application; associate the unique identifer with the target backend system; receive an API call corresponding to the API, the API call comprising a unique identifier from a client computing device; identify the unique identifier in the API call determine, via the common API, the target backend system associated with the unique identifier from the more than one backend systems associated with the API; and route, via the common API, the API call to the target backend system based on the unique identifer;

wherein the unique identifier is within a header of the API call;

wherein the one or more processors are further configured to receive a token with the API call and check that the token is valid for an application making the API call based on the unique identifier.

12. The API call router of claim 11, wherein the unique identifer is a subscription identifier unique to an application and a client.

13. The API call router of claim 11, wherein the target backend system is implemented by one of a plurality of data providers using the API.

14. The API call router of claim 11, wherein the one or more processors are further configured to receive a payload associated with the API call from the target backend system and send the payload to a client computing device.

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